

The Ecological and Economic Costs of Invasion

David Pimentel, Ph.D.,
Professor of Ecology and Agricultural Sciences,
Cornell University

The U.S. Department of the Interior estimates that in America the total land mass lost to invasive plants each year is twice the size of Delaware. Of course, this figure does not include the total area newly impacted by invasive animal species annually. No one knows exactly how many invasives are present in the northeastern United States; the data remain inadequate for estimates. But we do know that since European colonization, about 50,000 nonindigenous species have been introduced in America. Roughly 20,000 of these were first introduced into the Northeast. In the U.S., the economic impact of invasives is estimated at \$142 billion per year. Approximately 40 percent of the extinction of native species in the U.S. is due to predation, parasitism, and competition from biological invaders.*

Most alien plants in the Northeast were introduced for food, fiber, or ornamental purposes. An estimated 2,000 exotic plant species are now established in the wild, purple loosestrife (*Lythrum salicaria*), yellow rocket (*Barbarea vulgaris*), Canada thistle (*Cirsium arvense*), Eurasian milfoil (*Myriophyllum spicatum*) and Japanese knotweed (*Polygonum cuspidatum*) among them. These pest species are not only displacing native vegetation but are negatively affecting the animal species dependent on indigenous plants. Most of the plant pathogens, pest weeds, and insects in America are nonindigenous. Pests cause the loss of about 37 percent of all potential crop production, with losses and control cost estimated to be more than \$60 billion per year.*

...losses and control
cost estimated to
be more than \$60
billion per year...

*Pimentel, D., L. Lach, R. Zuniga, and D. Morrison. 2000. Environmental and economic costs of non-indigenous species in the United States. Bioscience. 50(1):53-65.

Two major invasive bird species in our area are the common pigeon (*Columba livia*) and the European starling (*Sturnus vulgaris*). Starlings are a problem on farms, consuming grains and fresh fruits. Pigeons and starlings in the U.S. are estimated to cause about \$2 billion in damages each year (see Table). In addition to pest birds, the Northeast has heavy populations of Norway and black rats (*Rattus norvegicus*; *R. rattus*) and European house mice (*Mus musculus*) that do extensive damage on farms. The 1.3 billion rats in the U.S. cause an estimated \$19 billion in damages each year.* Cats (*Felis sylvestris*) were introduced for mouse and rat control and now number 93 million, 30 million of which are feral. Feral and pet cats attack and kill an estimated 570 million songbirds per year.



House mouse (*Mus musculus*)

Phil Myers Ph.D. / animaldiversity.umnz.umich.edu



European starling
(*Sturnus vulgaris*)

Bob Hines / USFWS



Common pigeon
(*Columba livia*)

Bob Hines / USFWS

Throughout the U.S., some 140 invasive species of fish have been introduced, about 80 of these in the Northeast. The latter are causing about \$3 billion annually in damages to commercial and sport fisheries. For instance, the rapid decline of the valuable native walleye (*Stizostedion vitreum*) population in Lake Erie is thought to be at least partially caused by invasives such as the round goby (*Neogobius melanostomus*).



Round goby (*Neogobius melanostomus*)

USFWS, Lower Great Lakes Fishery Resources Office



Canada thistle
(*Cirsium arvense*)

Leslie Dietz
www.invasive.org

Severely degrading aquatic substrate conditions, the zebra mussel (*Dreissena polymorpha*) is one of the most costly and destructive invaders of the Northeast. This pest was first observed in Lake Ontario in 1988; by the following year it had arrived in Lake Michigan and the Fingerlakes in New York State. At present the zebra mussel invasion infests half this country's inland waters. The U.S. Geological Survey estimates that in the Great Lakes Basin alone, \$5 billion has been spent so far for damages and control efforts.

In fact, we are witnessing what some scientists call the "homogenization" of the earth's surface, the breakdown of biological boundaries caused by the unprecedented mobility of the human population and its transport mechanisms. Global climatic changes will add further complexity and unpredictability to the ecological impact of invasives. Americans should assume responsibility to mitigate the negative impacts of invasion brought about by the introduction of nonindigenous plants and animals.

Estimated Annual Costs of Some Common Invasives*

Crop pests (plant pathogens)	\$21,500,000,000
Human diseases	\$6,500,000,000
Purple loosestrife	\$45,000,000
Crop weeds	\$26,400,000,000
Aquatic weeds.....	\$110,000,000
Crop pests (arthropods)	\$14,000,000,000
Gypsy moths.....	\$11,000,000
Green crabs	\$44,000,000
Lawn and garden pests (arthropods) ...	\$1,500,000,000
Zebra mussels	\$500,000,000
Asian clams	\$1,000,000,000
Fishes	\$5,400,000,000
Pigeons.....	\$1,100,000,000
Starlings	\$800,000,000
Rats.....	\$19,000,000
Cats	\$17,000,000

*The data reflect total U.S. costs.
No information exclusive to the Northeast is available.